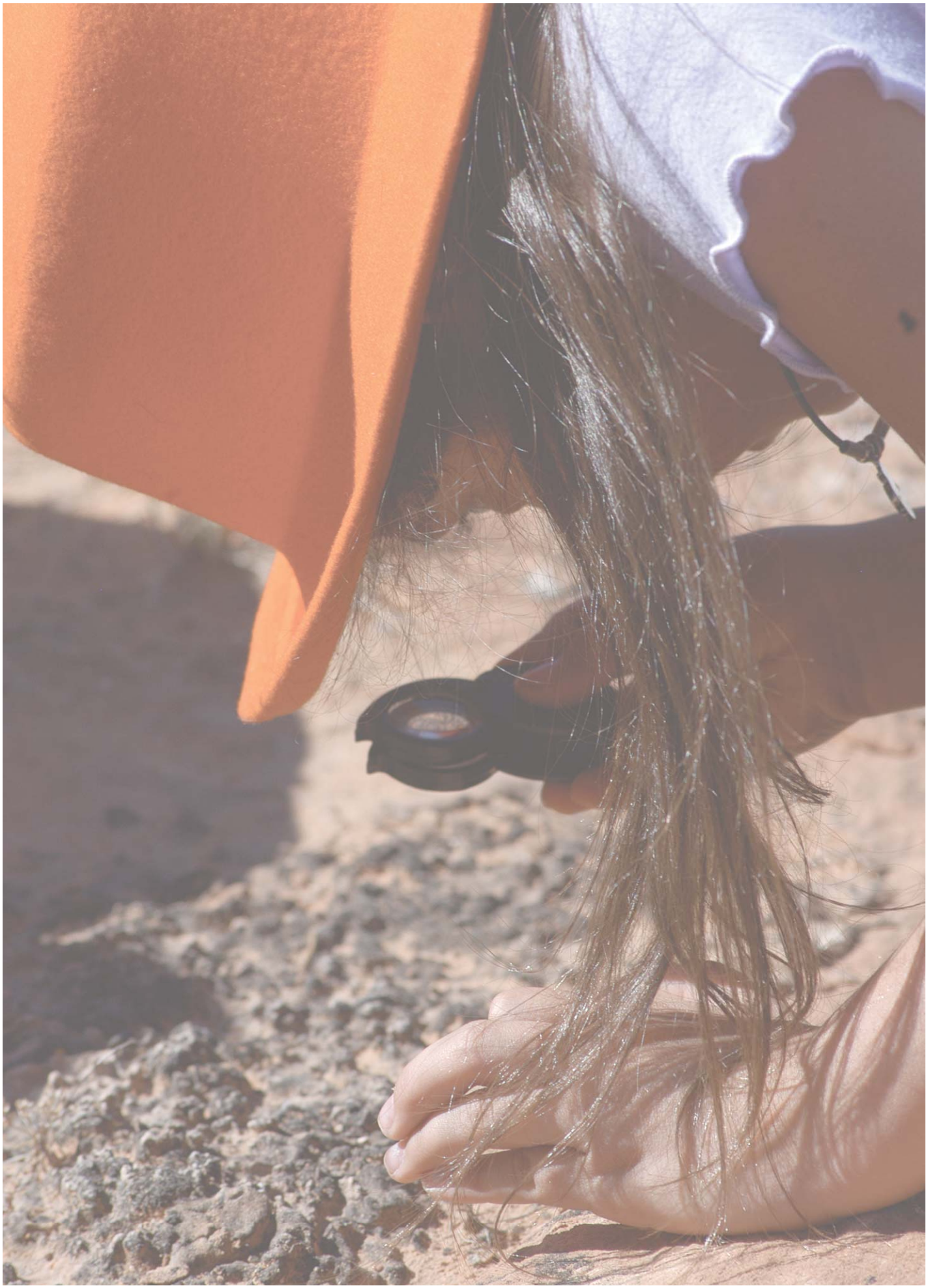
National Park Service
U.S. Department of the Interior

Southeast Utah National Parks & Monuments

Canyon Country Outdoor Education
Second Grade Curriculum



Canyon Country Outdoor Education

Second Grade Curriculum

National Park Service
Utah

June 2006

Contents

Viewing biological soil crust through a hand lens

CAITLIN LANGE

FIELD TRIP

Changes in Plants and Animals

Theme
Plants and animals respond to changes in the seasons in unique and fascinating ways.

Utah State Science Core Curriculum Topic
Standard Three: Students will develop an understanding of their environment.
Objective One: Investigate relationships between plants and animals and how living things change during their lives.

Field Trip Location
Courthouse Wash in Arches National Park, or anywhere with early to mid-spring growth, pond or stream, and some insect galls (for Station #4). If one of these elements is missing, the corresponding station can be omitted or altered. This is a spring field trip.

Times
All lessons are 30 minutes

Background

Plants sprout from seeds, grow, and produce flowers, which, if pollinated, produce more seeds. Plants need sun, soil, and water in order to make their own food and grow. Insects, hummingbirds, and bats inadvertently pollinate flowers while seeking nectar. Some plants, such as coniferous trees, rely on wind to distribute pollen.

Insects are an extremely diverse group of animals. They have exoskeletons, six legs, and three body parts. Although most insects have two pairs of wings, flies have only one pair and some have no wings at all. Wings are only found in adult insects. Most insects have a pair of some type of antennae. These and the tiny hairs sticking out of insect exoskeletons help the insects to feel, smell, and in some cases, hear. A simple heart pumps insect blood through its body cavities, distributing dissolved food and removing wastes. Because the blood does not carry oxygen, it is not red.

Insects undergo either complete or incomplete metamorphosis throughout their life cycles. Insects going through incomplete metamorphosis have three stages: egg, nymph, and adult. Nymphs often look like miniature adults, such as in grasshoppers, cockroaches, and aphids. However, some nymphs live in the water and look different than the adults. Examples include damselflies, dragonflies, and mayflies. Insects going through complete metamorphosis have four life cycle stages: egg, larva, pupa, and adult. Examples are butterflies, moths, flies, ants, wasps, and beetles. Larvae look completely different than their adult forms. Some larvae are aquatic and others are land-dwellers. A cocoon is a pupal case for a moth. A chrysalis is a pupal case for a butterfly.

Butterflies and moths experience complete metamorphosis. All of the parts of a butterfly are adapted for survival. The abdomen of the butterfly is large when it first emerges from its chrysalis. It becomes smaller when it starts

Scorpionweed

pumping fluids into its wings. In all its stages the butterfly breathes through tiny holes called spiracles. Wings are covered with millions of colored scales that camouflage the butterfly. The butterfly's proboscis (i.e. tongue) is used to sip nectar from flowers. The butterfly's compound eyes are made up of thousands of tiny lenses that help it see in all directions at once. Moths have different features than butterflies. The wings of a moth are not attached, whereas wings of a butterfly are hooked in flight. Moths are nocturnal; butterflies are diurnal. Most moths rest with their wings flat; most butterflies rest with their wings upright. Moths have feathered antennae; butterflies have straight plain antennae. While a moth's abdomen is fat, the butterfly's is thin. Moths form cocoons; butterflies form chrysalises.

Galls are temporary homes for some insects. They form when an insect chews on and injects a chemical into a plant, causing a swelling. Each species of gall-making insect has its own special species of plant that it must choose, or its specific gall will not form. The variety of sizes and shapes that galls take is impressive. Oak apples, bumps and lumps on hackberries, swellings on cottonwoods, cottony balls on rabbitbrush, and cone-like growths on Utah juniper are all types of galls, each created by one insect species. Each type of gall has its own story, but many house and feed the larva and pupa of a certain insect. The larva is commonly legless and blind, as its stage of the life cycle is contained within its food source, the gall's interior. Most gall-forming insects are small flies or wasps, but certain aphids, moths, beetles, and psyllids are also gall-formers.

Amphibians are animals that lead two lives. When they are young, amphibians are specifically adapted to living in the water. They use gills to breathe and use their tails to help them swim. As adults they walk or hop on land and use lungs to breathe. In the spring, frogs and toads lay a mass of eggs and attach this mass to rocks or sticks. The hatched tadpoles eat mostly bacteria and algae. The length of time an amphibian spends in this larval stage depends on the species. A bullfrog can take over a year to undergo metamorphosis; a spadefoot toad can change in less than two weeks. Eventually, however, most amphibians grow legs, loose their tail, grow lungs, and loose their gills. They begin to eat insects rather than plants and spend their time on land. Frogs and toads are not scientific distinctions. Rather, they are common terms used to describe either adult amphibians that have smooth skin and spend most of their time near water (frogs) or fatter adults with bumpy skin that spend most of their time away from water (toads). Other amphibians include salamanders and caecilians.

PRE-TRIP ACTIVITY

Wow! Things Change

Objectives

Students will be able to:

a. Name one change that plants go through during their life cycles.
b. Name one change that animals go through during their life cycles.
c. Identify the purpose of seeds in the plant life cycle.

Materials

Butterfly puppet; *The Tiny Seed* (Carle, 1987); *What Did I Look Like When I Was a Baby?* (Willis, 2000); *bullfrog song* poster (showing the words to the bullfrog song so kids can sing along. The song is found in the back of the book *What Did I Look Like When I Was a Baby?*)

Procedure

1) Introduce the field trip location, and see if any students have been there before. Write "Changes in Plants and Animals" on the board. Ask for a volunteer to read what is written, and tell students that they are going to be learning about these changes on their field trip. Tell students that you have a friend who is going to help them learn about these changes. Bring out the butterfly puppet. Have the puppet ask students what they know about changes that animals go through during their lives. Then, ask how plants change. Ask students what might prompt an animal or plant to change (temperature, seasons, and life stages).

2) Set the stage for reading a book about how plants change during the course of their lives. Remind students that illustrations often add to the information in a book. Show the book, and ask students to raise their hands if they've read it before. Read the book *The Tiny Seed*. Encourage students to "read" the illustrations, and pose questions while reading:

- What season is it? How do you know?
- Is it windy? What is happening to the leaves on the trees?
- Is it warm or cool? How do you know?

Summarize or wrap-up the book by discussing the purpose of seeds.

3) Read the book *What Did I Look Like When I Was a Baby?* Ask the students if they would like to sing the bullfrog song. Bring out the *bullfrog song* poster. Have the students sing along as you point to the words.

4) Ask students what season it is. Stress that weather can change quickly this time of year, and then go through what students need to bring on their field trip, drawing the list out from them and adding to it as needed.

EXTENSION

Have students create seed collages from seed catalogs, other sources of seed pictures, or wild seeds collected on a hike.

STATION #1

Season Suite

(Caduto & Bruchac, 1988, 129-133)

Objectives

Students will be able to:

a. Describe the parts of a wildflower life cycle
b. Name the four seasons, and describe how they influence the wildflower life cycle.

Materials

Spring Defeats Winter (Caduto & Bruchac, 1988, 129-132); *Season Suite* (Caduto & Bruchac, 1988, 132-133); name tags (*sun*, *bee*, *wind*, *raincloud*); one-quart squirt bottle; extra water bottle; small plastic tub of flour

PROCEDURE

1) Read *Spring Defeats Winter* to students. Discuss the story, asking students if they wanted Old Man Winter to melt the warmth of Young Man Spring, which seasons are their favorites, and what causes the seasons. Ask students to identify the four seasons, and discuss the changes that occur during the seasons. Include discussion of temperature and day length changes, and launch into the subject of how plants change through the seasons. Be sure students know what stage the plants are currently in and what season it is now.

2) Go on a brief search for signs of spring in the plants. Look at wildflowers or, if it's earlier, young, green sprouts of grasses, wildflowers, or shrubs. Relate these discoveries to the season.

3) Tell students they will be acting out a story of the changes that a wildflower goes through during the different seasons. Assign and explain parts, and set limits on the use of materials. The *sun* will radiate energy. *Raincloud* gives each flower two or three squirts with the spray bottle when it rains in the story. The *bee* will have a container of pollen (flour) to pollinate the flowers (with just a small *pinch* of flour). The rest of the students are annual wildflowers. Explain that annuals are plants that grow from a seed each year and make new seeds by the end of the year. Discuss a few examples of plants that are annuals and plants that are not.

4) Rehearse the play at least once. You may choose to rehearse it several times and then perform a final show for a parent or teacher, or you may choose to repeat the play a few times with students assuming different roles. Prompt students about what comes next as they perform.

EXTENSIONS

Have students interview each other to discover the details of the wildflower cycle and the effect seasons have on the cycle.

Coordinate students in creating a classroom wildflower cycle display using construction paper or other materials.

Seedling in biological soil crust

STATION #2

Swim, Swim and Hop a Lot

Objectives

Students will be able to:
a. Describe the stages of the amphibian life cycle.
b. Describe why frogs sing in the night.

Materials

frog puppet; *Merry Metamorphosis* Poem; pictures of frogs at various stages; pictures of local frogs and toads with interesting information; frog call identifier.

PROCEDURE

1) Tell the students that you have a friend who is going to help you teach this station. Bring out the frog puppet. Tell the students that they are going to be learning about frogs and toads. Ask if any of the students know the difference. Have the puppet tell the students that there is no scientific difference, but that we describe frogs as amphibians with smooth skin that live near water and toads as amphibians that have bumpy skin and live mostly away from water. Have the puppet ask the students what else they might know about frogs and toads. Ask the students if they can tell you what an amphibian is. Tell the students that amphibians are animals that go through big changes in their lives. Describe the stages.

2) Ask the students to gather in the center of the circle in a clump. Tell the students that they are going to act out the frog life cycle (adapted from Lingelbach, 1986, 63-65). Have the students listen carefully, as you will be reading a poem and giving directions. Read and act out *Merry Metamorphosis*.

3) Divide the students into two groups. Tell them that students in one group are going to be tadpoles and those in the other group are going to be adults. Show the students a picture of a frog at some point in its life cycle. Tell the students that if they think the picture matches their group, they should raise their hand. If the group is correct, have the group leap frog to a nearby bush and back. This should be repeated 6-10 times with various pictures. When all the pictures have been claimed, have the students arrange them in order on the ground.

4) Show students pictures of local frogs and toads. Describe interesting information about them. Ask the students if they have ever heard frogs singing at night. Discuss how calls attract mates. Ask the students why they think the frogs might be singing. Play a recording from a frog, and ask the group to try and mimic it. Repeat with several different calls. Have each student pick a different call, and play the call for that child to remember. Have everyone make their calls at the same time. Ask for a volunteer who thinks they have good hearing. Pull the volunteer aside, and play one of the calls for him/her. Tell the volunteer he/she needs to find his/her mate by finding the student making the same call (adapted from *Let's Hear it for Herps*, 1987, 26).

5) If there is extra time, scan the stream banks for egg sacks.

Leopard frog

MERRY METAMORPHOSIS

(adapted from Lingelbach, 1986, 65)

(Students stand huddled together hands at their sides swaying slightly.)

If you look closely in a pond
By chance you just may see
A mighty mass of frog eggs
Floating in the water free

Moving with the water
As it ripples here and there
How nice to be a frog egg
Not a worry or a care

As days go on, those frog eggs
Will start to look quite strange
If you look closely in that pond
You're sure to see the change

(Students begin to move apart.)

Coming from that mass of eggs
Are not a bunch of frogs
But rather little tadpoles
Also known as polliwogs

They have no legs to hop with
Or lungs to breathe the air
For they stay under the water
Eating plants that grow down there

(Students move about with their feet together and their hands behind them like a tail.)

They're sort of round up front
Their backs have wiggling tails
They don't look a bit like frog
But more like tiny whales

If you look closely in that pond
And watch them every day
You'll see the tadpoles start to change
In yet, a different way

On each side of that wagging tail
Legs will start to grow
The tadpoles start to use them
For swimming to and fro

(Students move with feet apart, hands still behind them.)

Soon some front legs will appear
And that's not even all
For as they do, you'll notice
The tail will get quite small

(Students wiggle arms in front of them with elbows at their sides.)

The body shapes begin to change
Both inside and out
They breathe with lungs and start to eat
The bugs that swim about

With big hind legs to hop with
And a tail that's gone for good
Those tiny little frog eggs
Now look like they should

(Students assume frog position. take big gulps of air, hop around, and pretend to catch insects.)

For as you look closely in that pond
Or on some nearby logs
You'll see more than eggs and tadpoles
You'll see some baby frogs!

STATION #3
Flutter by

Objectives
Students will be able to:
a. Describe the life cycle of a butterfly.
b. Name two differences between butterflies and moths.

Materials
The Hungry Caterpillar (Carle, 1969); incomplete metamorphosis puzzle; complete metamorphosis puzzle; pictures of different butterflies; *life cycle obstacle course signs*; butterfly model; moth model; pictures of butterflies and moths with their name and information on the back

Note
Set up life cycle obstacle course ahead of time.

PROCEDURE

1) Have students get comfortable and read them *The Hungry Caterpillar* by Eric Carle. Many of the students will be familiar with this book, so rather than focusing on the story, concentrate on discussing the stages of the caterpillar's metamorphosis. Tell the students that there are two ways insects grow into adults: incomplete and complete metamorphosis. Give each student a puzzle piece, and ask the students to put together the incomplete and complete metamorphosis puzzles. Discuss the difference between the puzzles, and ask students which kind of metamorphosis the "Hungry Caterpillar" experienced.

2) Tell students that they are going to go on a lifecycle obstacle course (adapted from earthsbirthday.org). Tell students that they are going to set out one at a time and follow the signs through the course. At each sign, they need to do what the signs tell them as they follow the arrow to the next sign. As the students finish the course, ask them to try to find signs of butterflies, e.g. eggs on leaves, chrysalises, and butterflies.

3) Explain the four things butterflies spend their lives doing and the actions that they are going to use to act them out. Play a few rounds of Butterfly Says (similar to Simon Says adapted from Clover Kids).

Basking – Because butterflies are cold blooded, they must spend time absorbing heat from the sun. Have students stand with their arms outstretched.

Nectaring – Butterflies eat by sipping nectar or other liquids through their proboscis. Have students hold their hands to their mouth with one finger outstretched and make a slurping sound.

Puddling – Male butterflies sip water and salts from puddles. Have students hold hands to mouth like a proboscis and kneel down to the ground.

Mating Dance – Dance around to attract a mate. Have students dance.

4) Show students a model or puppet of a butterfly. Discuss several of the parts including the abdomen, antennae, thorax, compound eyes, proboscis, wings, and spiracles. Discuss how adaptations of different parts help the butterfly to survive. Bring out a model or puppet of a moth. Examine its body parts, and compare them to the butterfly. Hand out pictures of butterflies and moths to each student. Have the students examine their pictures and read the information on the back. Let each student introduce their butterfly or moth by showing the picture, telling the group its name, whether it is a butterfly or a moth, and something they learned about butterflies or moths.

LIFE CYCLE OBSTACLE COURSE SIGNS

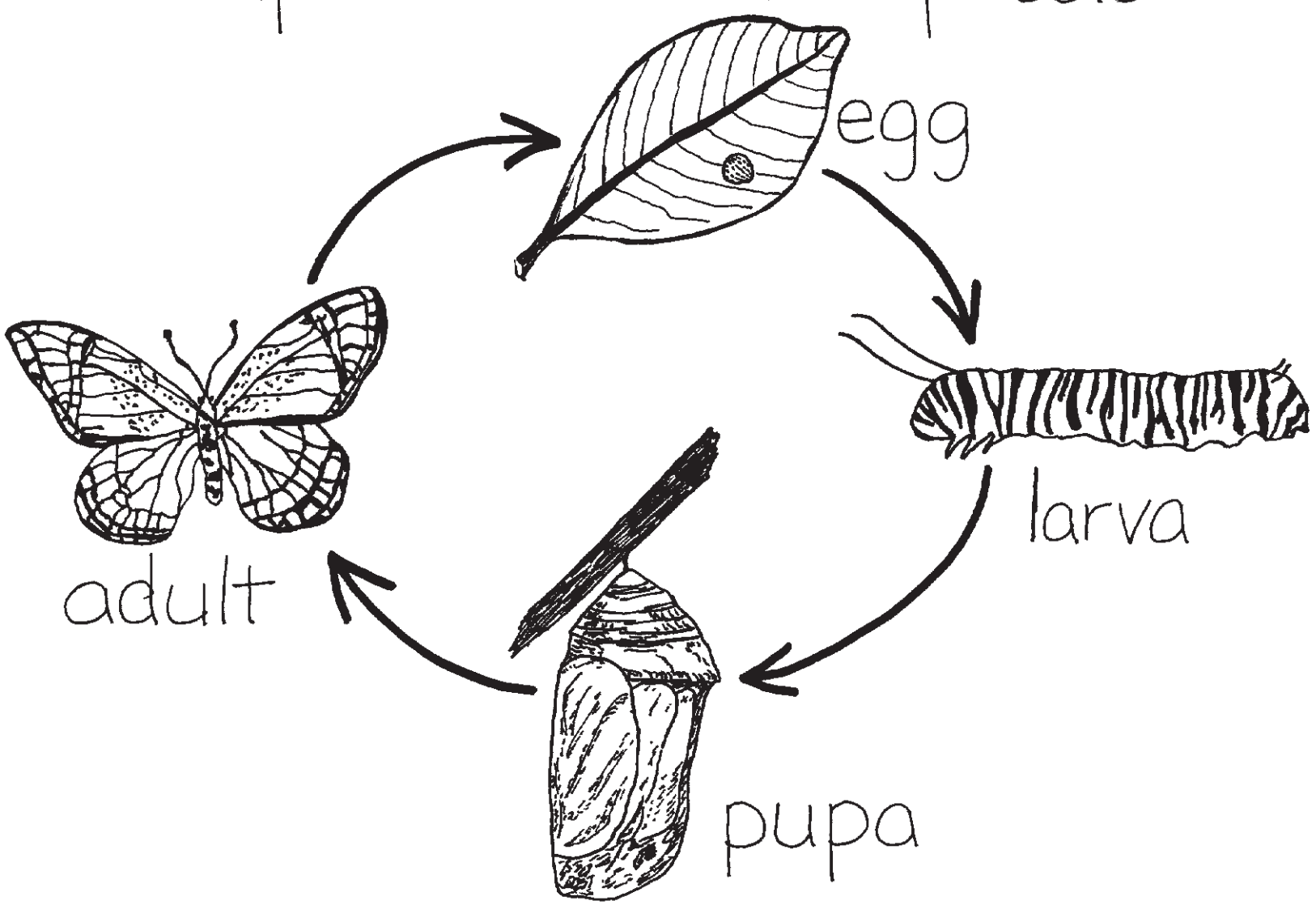
Sign 1. Place in a sandy area underneath trees. "Egg – Curl up small like an egg. Then, pretend to hatch. Crawl to the next sign."

Sign 2. Place in the shrubs. "Creep and Crawl – Crawl like a caterpillar through the shrubs. Pretend to eat the leaves."

Sign 3. Place in area with high branches. "Just Hanging – Stand and clasp one of the branches like a pupa. The pupa shakes because the adult is just about to hatch and is squirming inside to break free. Count to 20. Hatch, and fly away."

Sign 4. Place in an open area. "Flower Power – Flap your wings, and fly around sipping nectar."

Complete Metamorphosis



STATION #4

What Gall!

Objectives

Students will be able to:

a. Identify galls and see differences between different types of galls.
b. Describe the different stages of complete metamorphosis.

Materials

complete metamorphosis poster; variety of galls; bug boxes; *Gall Fantasy* (Lingelbach, 1986, 87);

Note

Before the station, put a few of one type of gall such as the cottony rabbitbrush gall into bug boxes. Cut one gall open so students can view larva inside.

PROCEDURE

1) Have students examine the galls in the bug boxes, noticing color, shape, size, texture, where it grows, and if and where there are holes in the galls. Then, have students examine the pre-cut gall, with an insect in its grub-like larval stage. Have them look, too, for how much of the gall's interior has been eaten by the host larva. Students may see insect invaders or invasion holes in a gall. Tell them the story of galls, including the following points:

a. Galls are temporary homes for insects.
b. Galls form when an insect chews on and injects a chemical into the plant, causing a swelling.
c. Gall-making insects each have their own special species of plant that they must choose, or the gall will not form.
d. Each kind of gall insect causes its own specific type of gall to form. Show students a variety of galls.

2) Using the poster, review complete metamorphosis stages. Tell students that a gall is a source of food, usually for the larval stage of an insect. In your explanation of a gall's purpose, use the analogy of a child stuck in a gingerbread house in a very cold, snowy place for the winter, eating the inside of the house for food and keeping warm in the house.

3) Go on a gall hike, and look for galls growing on different plants. On the return, ask children to silently count how many galls they see on the way back to the station site. (This works well where there are a great number of galls this time of year, such as some areas of thick rabbitbrush, coyote willow, big sagebrush, or Utah juniper.) Have students compare how many galls they found.

4) Read *Gall Fantasy*, and have students follow the guided imagery.

GALL FANTASY

You are about to become tiny, defenseless creatures. Please, very quietly, get your jackets and find a place where you can be protected, but where you can easily hear my voice. Crouch, become as small as you can, put your jacket over your head and be very silent. Close your eyes.

It is fall now, the days are growing shorter and nights are cold. But you can't see the daylight or feel the chill; you are snug in your gall home. You can eat, your food is all around you, warm and dry, and you need only reach out to the nearest wall for food. *Eat*, rest, and *eat* again.

The leaves have fallen, beaten to the ground by gusty winds and pelting rain. You are safe and dry in your gall home. But you are alone and it is dark.

Autumn turns to winter. The snows have come, the ponds are iced, and winter buries food for creatures like you.

The sun is higher now, owls are nesting, streams are thawing, and you are growing bigger. It is warm, the snow is melting, and the sap is running. You sleep your final sleep, deep inside your private gall. The time has come for you to change.

The days are growing longer and warmer. Grass is green and flowers bloom. Your gall home is brown and dry. You feel an urge to stretch and move, stretch and move, and suddenly you are out of your gall, standing tall, soaking in the sunlight, drying your wings. You are an adult.

(Reprinted with permission from *Hands-On Nature: Information and Activities for Exploring the Environment with Children*,1986. Edited by Jennepher Lingelbach. Vermont Institute of Natural Science, Woodstock, VT 05091.)

POST-TRIP ACTIVITY

Cycles, Cycles, Cycles

Objectives

Students will be able to:

a. Describe the life cycle of a flower.

b. Name the four stages of complete metamorphosis.

Materials

The Reason for a Flower (Heller 1983); *complete metamorphosis* poster; insect metamorphosis stage cards (cards with a name of an insect stage on each); amphibian metamorphosis stage cards(cards with a name of an amphibian stage on each).

PROCEDURE

1) Discuss the field trip with students, emphasizing the various life cycles explored.

2) Read *The Reason for a Flower* to the students.

3) Review the stages in the life cycle of a flower. Ask students to stand up, push their chairs in, and stand behind their desks. Tell them that they are going to act out the life cycle of a flower. Have students crunch into a ball to represent seeds. Grow a stem, by standing up. Stretch out and wave their hands to represent leaves. Cup their hands together to form a flower. Form a fist for a fruit, which has seeds that drop to the ground. Have students return to the seed position. Repeat several times getting faster and faster till everyone is laughing.

4) Review the stages of insect complete metamorphosis, having students act out each stage as you review; egg – small ball, larvae – wiggle like a worm, pupa – hands above their head forming a cone; adult – flap their wings. Then hold up stage cards, one at a time, asking students to act out each card. Vary the order, and increase your speed.

5) Review the stages in the life cycle for an amphibian. Again, ask the students to act them out; egg - curled up in a small ball; tadpole – hands behind like a tail; adult – leaping like a frog. Then, hold up stage cards, one at a time, asking students to act out each card. Vary the order, and increase your speed.

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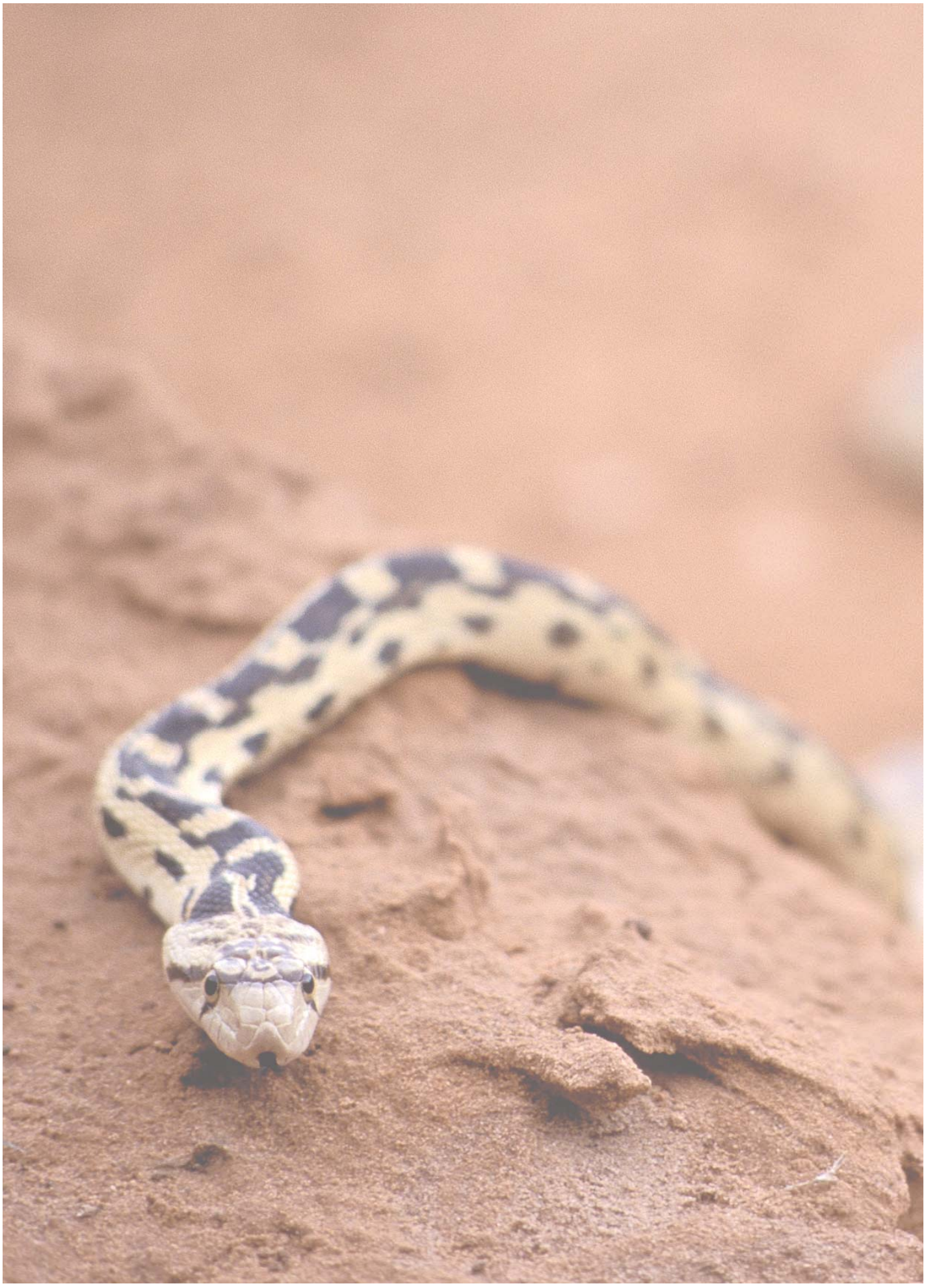

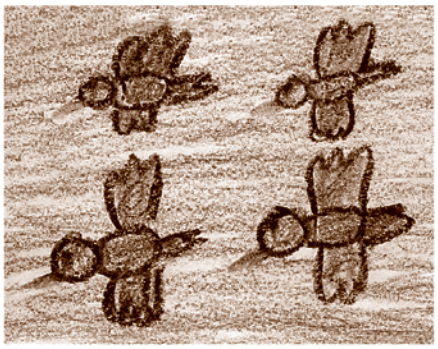

MOLLY JONES

IN-CLASS PRESENTATION

Preparing for Winter

Theme
Animals and plants prepare for winter in a variety of ways.

Utah State Integrated Core Curriculum Topic Standard Three: Students will develop an understanding of their environment.

Objective One: Investigate relationships between plants and animals and how living things change during their lives.

Objectives
Students will be able to:
a. Describe three things animals do to survive the winter.
b. Name what one specific animal does to survive the winter.

Time
30 Minutes

Materials
"*How Turtle Flew South for the Winter*" (Caduto, M. & Bruchac, J., 1988, 157-158); *what animals do in winter* poster(poster depicting a variety of animals grouped in the way they spend the winter, i/e hibernators, migrators, those that remain active, those whose eggs remain dormant, and those that store food) "*Winter is Coming*" (Caduto, M. & Bruchac, J., 1988, 160), paper, crayons

PROCEDURE

1) Ask students if they have noticed that winter is coming. If so, ask them how they knew. Tell students that animals, like humans, notice the change of the seasons and do many different things to survive the winter. Ask students if they know what a legend is? If not, explain that a legend is a story some people think might be true and others think is just a story. Tell the students that you have a legend that was told by the Dakota (Sioux) Indians who live on the Great Plains. Read "*How Turtle Flew South for the Winter*."

2) Tell students that even though the story was probably not entirely true there were some elements of truth. For instance, birds fly south for the winter and turtles dig holes and sleep in the mud all winter. Show students the poster of animals. Discuss what each group of animals does to survive the winter: becoming dormant, hibernating, migrating, storing food, remaining active, laying eggs. Point out and name the different animals in each group.

3) Tell the students they need to pick one of the animals from the poster to pretend to be. Have the students close their eyes and, without moving, think about what it would be like to be that animal. Read them the visualization "*Winter is Coming*." Remind students that they need to picture these things happening as if they are their animal. After reading, give students a moment or two to think of how they would survive.

4) Pass out drawing paper. Have students draw their animal and how it survives the winter. Give examples, such as "if you were a snake you could draw yourself asleep in your den" or "if you are a bird you could show yourself flying south for winter." Have students then write who they are and what they do to survive the winter. If there is time, have each student share her picture with the class.

EXTENSION

Have the students write a story about how their animal survived the winter.

Gopher snake

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Learning to avoid cryptobiotic crust

ASHLEE R. HASS

FIELD TRIP

Rocks

Theme
The characteristics of rocks influence both our landscape and our lives.

Utah State Integrated Core Curriculum Topic
Standard Three: Students will develop an understanding of their environment.
Objective Three: Investigate the properties and the uses of rocks.

Field Trip Location
Any of the many sandstone slickrock areas of southeastern Utah. Sand Flats Recreation Area east of Moab is an excellent location. On the other hand, any outdoor location could be used for Stations #1 and #4, and any location with sandstone could be used for Station #2. A location with cryptobiotic soil is needed for Station #3.

Times
All lessons are 30 min.

Background

Rocks are made up of one or more minerals. Minerals are naturally occurring elements (e.g., gold) or inorganic compounds (e.g., quartz) that have specific crystal structures.

There are three major kinds of rocks: igneous, sedimentary, and metamorphic. Igneous rocks form from molten rock (magma) that has cooled. Examples include granite, basalt and pumice. They are usually unlayered (except basalts) and often contain visible crystals. Sedimentary rocks form when sediments that are deposited by water or wind on the surface of the earth, harden and solidify over time, as they are buried by more sediment. Sedimentary rocks commonly look layered. Metamorphic rocks are rocks of any type that have been altered (not melted) by heat or pressure. Sandstone metamorphoses into quartzite, limestone into marble, and granite into gneiss. Crystals commonly seen in metamorphic rocks are usually oriented in lines or sheets, at times giving both small hand samples and outcrops a wavy or crinkled appearance.

Rocks change. Heat or pressure can metamorphose any type of rock. If a rock is heated to the melting point and later recrystallizes, a new igneous rock can form. Any type of rock can erode, be redeposited, and become a sedimentary rock. These processes, changing one type of rock into another, are known collectively as the *rock cycle*. Many simpler cycles exist within the complex rock cycle. Metamorphic rocks may be remetamorphosed. Igneous rocks may melt and recrystallize.

Most rocks in southeastern Utah are sedimentary, and the most common sedimentary rock is sandstone. Sandstone is made up of quartz sand grains cemented together by calcium carbonate or silica. The red appearance of many types of sandstone in the area is due to oxidized iron that coats the sand grains. Generally, sandstone is easily eroded. Water is the most effective agent of erosion, but gravity and wind also play a part. The erosion of sandstone formed the unique canyons, needles, arches, natural bridges,

spires, and balanced rocks of southeastern Utah.

Petrified wood forms when minerals (usually quartz) replace organic materials in wood. Chert is microcrystalline quartz, without the cellular structure visible in petrified wood. It is very hard and breaks conchoidally. Limestone is calcium carbonate deposited on ocean floors.

Granite is found in the La Sal Mountains near Arches and Canyonlands National Parks. It is a hard igneous rock that cooled from magma while still underground. Granite is composed primarily of visible crystals of quartz, mica, and feldspar. Generally, granite erodes more slowly than sandstone. Small pebbles eroded from granite, along with organic materials from mountain vegetation, contribute to rich mountain soil.

Deserts have less, smaller, and slower-growing vegetation than mountains, so desert soils have a low organic content. Biological soil crusts are extremely common in the southeastern Utah high desert and help to make up for this lack of organic matter. The soil crusts are a community of small organisms that form a living mat and secure the top few inches of sand particles against water and wind erosion. The crusts also increase absorption and retention of water and add nitrogen to the soil, an essential for plant growth. Biological soil crusts give desert soils a lumpy, spongy look, a result of gases produced by each living, breathing community member.

Because of their incredible importance and extreme fragility, the preservation of biological soil crusts is the target of many educational efforts within the southeastern Utah national parks. To avoid walking on the crusts, hikers should walk on slickrock, on trails, or in washes. Don't bust the crust!

Biological soil crusts are common throughout southeast Utah-

PRET-TRIP ACTIVITY

Just What Are Rocks Anyway?

Objectives

Students will be able to:

a. Understand that rock underlies everything on the surface of the earth.

b. Name one set of categories that can be used to classify a rock collection.

Materials

Rock Collecting (Gans, 1984); *Everybody Needs a Rock* (Baylor, 1974); a variety of rocks.

PROCEDURE

1) Tell students that they will be exploring rocks on the upcoming field trip. Inform them of the field trip location and the food, water, and gear they need to bring to school on the day of the field trip.

2) Ask students if any of them have a rock collection at home. Have one or two students describe a favorite rock from their collection. Tell students that rock collecting is fun, but in some places it is not allowed. See if students can guess why you should not collect rocks in certain areas. Talk about areas in which rock collecting is inappropriate. Read and discuss the book *Rock Collecting*. Emphasize that rock underlies everything on the earth's surface. Review the book by asking a few students to name ways that rocks can be classified (for example: color, hardness, or the three rock types).

3) Give a rock to each student. Have students pass the rocks around the room, allowing each student the opportunity to see each rock. Ask a few students to stand up, show their rock to the class, and say something about it. Discuss how these observations can help in classifying rocks. Collect the rocks.

4) Read and discuss the book *Everybody Needs a Rock*. Inform students that although we won't be collecting any rocks on this field trip they may wish to at another time.

5) Reinforce what students should bring to school for the field trip by having students raise hands and take turns listing the items.

EXTENSION

Have students start a rock collection from rocks found in the schoolyard. Have students categorize the collected rocks by observable characteristics.

STATION #1

Rocks, Rocks and More Rocks

Objective

Students will be able to:

a. Identify and describe, using observable characteristics, three specific kinds of rocks found in the area.

Materials

blindfolds; rock samples (e.g., sandstone, granite, limestone, chert, and petrified wood).

PROCEDURE

1) Tell students that they will be examining rocks and you have a "magic box" full of rocks that you are going to share with them. As you show the rocks to the students, tell them the story of how each rock was created. Then hand out the rocks, one type at a time. As they pass them around the circle, ask students which rock they think is the hardest, softest, and heaviest. Ask them to point to the rock that matches what they are sitting on.

2) Ask students to sort the rocks by making piles. For example, have the students put all the rocks that were once liquid in one pile and all the rocks that were once living things in another. Have students sort the rocks in 5 or 6 different ways.

3) Split the students into pairs and blindfold one student in each pair. Ask that student to remain seated. Put all the rock samples in a pile and have the students without blindfolds choose one rock each to take to their partner. Have the blindfolded students feel their rocks (behind their backs so they can't peek). Ask them to feel for shape, size, weight, and texture. When they are done, tell them to hand the rock back to their partners, who will return the rocks to the pile. With blindfolds removed, students try to determine which rock they felt. Ask how they recognized their rocks. Tell partners to switch roles and repeat the activity. Discuss how geologists can tell the difference between kinds of rock by asking themselves similar questions: How heavy is it? Is it hard or soft? How does it break? What color is it?

4) Play the Rock Type Relay. Divide students into two relay teams. Place a pile of rocks 25 feet from a starting line. Explain that you will call out the name of or something about a rock. The first student in each team must run, pick up a sample of the rock, and run back to his/her team. Teammates must look at the selected rock and give a thumbs-up or thumbs-down. The runner then gives the rock to the next person in line to put back as they are getting a new rock.

Rock Type Relay

STATION #2

Build Up, Tear Down

Objectives

Students will be able to:
a. Name two processes that change rocks.
b. Name two things that harden rocks.
c. Name two things that erode rocks.

Materials

mountain overlay poster(a flip chart that depicts the changes in local geology through time); secret decoder; clues; *recipe card*; *ingredient cards*; water; arch formation poster(poster depicting the stages of arch formation).

Note

Hide the ingredient cards before the students arrive.

PROCEDURE

1) Ask students if they think that the way the earth looks changes over time? Tell them that the area where they are sitting looked different millions of years ago. In Colorado, there was a mountain as tall as Mount Everest. In Moab, there was an ocean. Show students a poster with overlays. Explain that over time, the dirt from the mountain washed down into the ocean, eventually hardening into rock.

2) Ask students if they know how sand hardens into rock. Tell students the recipe has four ingredients. Ask if they would like to go on a treasure hunt to find the missing ingredients for making sandstone. Ask students to walk fast, but not to run. Read the first clue, which will lead students to the *sand* card. Have students read *sand* together. Place the card on the *Recipe Card*. Continue in the same manner, next finding *pressure*, then *water*, and finally *time*. Demonstrate the meaning of pressure by having students and adults put their hands together in one pile. Ask if the hands near the bottom can feel the pressure.

3) Tell students it is time to try to make sandstone. Go to a sandy area and have each student make a personal pile of sand on a nearby rock. Ask students to apply pressure to their sand by stomping on it. Squirt a little water on each pile and discuss the role of water moving between sand grains and cementing them together. Tell students that for the time ingredient, they just need to keep stomping for another 5,000 years. Ask if they would be bored (or dead) before then.

4) Teach and practice the *Sandstone Recipe Rhyme*: "Sand, pressure, water and time; that's the sandstone recipe rhyme." Teach hand motions to go with the rhyme, moving fingers for "sand," pushing hands down for "pressure," make fish swimming motions for "water," pointing to wrist for "time," and marching in place with arms swinging (or snapping fingers) during "that's the sandstone recipe rhyme."

5) Tell students that once sandstone is exposed to the air it starts to erode. Ask students if anyone can tell you what erosion is? Explain that *erosion* is the wearing down or weathering of rocks. For example, ask the students if they have ever burned a piece of toast and then taken a knife and scraped off the burned part, making all the burnt crumbs fall on their plate? Tell the students that they were eroding their toast, slowly wearing it away and making small pieces fall off. Ask students if they think the rocks erode because some giant is scraping them with a knife. Discuss real causes of erosion, such as wind, water, and ice.

6) Take a short hike on the sandstone, showing and/or asking students to find examples of erosion. Find a crack in the sandstone and discuss how water might get into the crack. Tell students that ice is the number one cause of erosion. Have everyone stand shoulder to shoulder in a circle. Tell the students that they are water molecules during a nice warm day. Explain that the sun is going down, it is getting really cold, and they are freezing. Have them stick out their elbows. Point out how the circle got bigger when the water molecules froze. Ask students if they've ever put a can of pop or a water bottle in the freezer and forgotten it. What happened? Explain that water expands when it freezes, making the cans or bottles explode. Explain that when water thaws it gets smaller again. Have everyone stand shoulder to shoulder again and go through the cycle of night and day, freezing and thawing, a few times. Next, pick two students and have them press their hands against each other. Explain that when water seeps into a crack and freezes it pushes the crack apart because of the expanding molecules. Put your hands in between the students' hands. As the ice thaws allow your hands to seep lower into the crack between their hands, demonstrating the thawing/freezing process. Do this several times until you have pushed their hands several inches apart.

7) Remind students that there was once sandstone covering this whole area and everything they see is the result of erosion.

Have the students create a model by building a mound of sand with rocks in the mound periodically. Tell the students that some sandstone is harder than others. Explain that the hard sandstone erodes more slowly than the soft sandstone, making the unique formations throughout the area. Have the students take turns pouring water on the mound. Point out the exposed rocks and the newly created formations.

8) Use the Arch Formation poster to describe how erosion causes cool formations such as arches. Use the damp sand to guide students through the process of arch formation, emphasizing the importance of water and ice. Let students then build their own arches and other erosional features. Emphasize that erosion takes a long time and that they are really speeding up the hands of geologic time!

Learning about the erosive force of water

SANDSTONE RECIPE CARD

Recipe For Sandstone

1.

2.

3.

4.

SANDSTONE INGREDIENTS

Cut apart and apply velcro or other sticky substance to back of each.

SAND

PRESSURE

WATER

TIME

STATION #3

Secrets in the Soil

Objectives

Students will be able to:

a. Explain two roles of biological soil crusts.
b. Name two places to walk in order to avoid stepping on biological soil crusts.

Materials

crypto puppet; crypto poster; crypto mat; the Sandstone Rock Cycle poster that highlights sand; potting soil or mountain soil in a bucket; sand in a bucket; crypto puppet (a brown sock puppet with button eyes and a brown lump of carpet padding or something spongy and crusty-feeling that resembles a bump of cryptobiotic soil); small poster that lists four functions of cryptobiotic soil (It holds the sand in place and prevents erosion, soaks up and holds water like a sponge, provides nutrients or fertilizer for other plants, and provides protected places for seeds to grow.); crypto mat (a 6'x 3' piece of carpet padding with several 1"-2" tall lumps of brown or black carpet padding glued onto it); hand lenses; cyanobacteria pictures

PROCEDURE

1) Have students look around and ask them if they see anything other than rock. Ask the students what happens to the sand when the wind blows? Ask them why all the sand does not blow away? Tell the students that there are living substances, biological soil crusts that keep the sand in place.

2) Introduce the crypto puppet to students, and have the puppet use the poster to tell students about the roles of biological soil crust. Emphasize that the crust holds the sand in place, preventing erosion, soaks up and holds water like a sponge, provides nutrients or fertilizer for other plants, and provides protected places for seeds to grow. Have the puppet tell the students that there's one thing that all crust fears: being crushed.

3) Tell students that you are going to go on a hike to look for biological soil crusts. Discuss the three good places to walk to avoid stepping on crusts: on trails or roads, on slickrock, or in washes. Have the students practice by taking turns tiptoeing across the crypto mat, trying to avoid stepping on any of the bumps in the soil crusts.

4) Go on a hike. Point out older and younger biological soil crusts. Have students lay belly-down on the slickrock adjacent to a pothole garden and look closely at the soil crust. Tell the students that soil crusts are intricate things; challenge them to look without talking for 30 seconds. Afterwards, ask each student to name one thing the area reminds them of: i.e. garden, nursery, bed, lumpy bumpy pillow. Hand out a hand lenses to each student and let them examine the soil crusts. After a few minutes, ask each student to name something that they see. Ask students to point to some of the different organisms that colonize the soil crusts: i.e. lichens and mosses. Show students pictures of magnified cyanobacteria and tell them this is what lies underneath the soil. If some crust is already loose, show students the real thing. Ask them to point to a good landing place for a seed, a spot where it won't be blown away. Discuss some of the other ways soil crusts help plants grow. Point out the larger plants in the pothole garden and discuss why soil crusts help them to thrive.

5) Return to the starting area. Review the roles of biological soil crusts and the three best places to walk in order to avoid busting the crust.

EXTENSION

Have students imagine they were shrunk to a size smaller than an ant. Have them write a story or draw a picture of their adventures exploring the pothole garden or crypto condo.

STATION #4

Rocks: Past and Present

Objectives

Students will be able to:
a. Name two modern uses of rocks.
b. Describe how people used to use rocks.

Materials

examples of stone tools; pictures of modern uses of rocks; "*make a fork*" poster (a poster that depicts the path ore takes from the mine to a finished metal product); "*ancient uses of rock*" poster (depicting stone tools and other evidence of the ways rocks were used); pictures of modern items corresponding to those depicted in the "*ancient uses of rock*" poster.

PROCEDURE

1) Ask students if at one time people use rocks in their lives every day? Have students suggest some ways that ancient people used rocks: i.e. arrowheads, grinding stones, etc. Show students some examples of ancient rock technology. Discuss what each was used for. Ask students why different rocks might have been used for different purposes? For example, ask students if sandstone would make a good knife? Discuss why chert was used for arrowheads? Ask students if they thought it was hard to make arrowheads and other tools?

2) Show students actions that symbolize many of the different stone tools. Play a quick game of ranger says using these actions.

3) Ask students if they believe people still use rocks every day? Have students give some examples of how rocks continue to be a part of our lives: i.e. jewelry, landscaping, pencils, etc. Show pictures of modern uses of rocks. Discuss with students how many of the rocks we use today have been changed or refined. Show students some examples of objects that were made out of rock ore. Have students name some other objects that were made out of rock. Explain how the refining process works by showing them the poster of the making of a fork.

4) Show students the Ancient Uses of Rock poster. Discuss each use with them. Tell the students that hidden around the area are pictures of the way we use rocks today. Tell them that they will have a few minutes to look for these pictures. If they find one, they have to bring it back and place it on the poster next to the corresponding ancient use for the rock. Remind students to keep their feet on the slickrock and that each student may only find 2 or 3 pictures.

MODERN OBJECT VS. ANCIENT OBJECT EXAMPLES

Pots and pans – ceramic pots
Knife – Knife
Bowls – Ceramic bowls\
Buildings – Buildings
Roofing – Roofing
Grinding stone – mano and matate
Landscaping – Farm development
Jewelry – Jewelry
Spatula – Stone scraper
Decorations – Decorations
Bullets – Spear points and arrowheads
Axe – Stone axe
Hammer – Stone hammer

POST-TRIP ACTIVITY

Rock Art

Objectives

Students will be able to:

a. Describe two things about a rock that could easily be missed.

b. Name one use for a rock.

Materials

posters showing igneous, sedimentary and metamorphic rocks; rocks for every student; paper; crayons.

PROCEDURE

1) Review field trip stations with students. Ask students to recall some ways people use rocks. Have volunteers name several different examples. Ask students if they can remember learning about a microscopic organism that helps to prevent erosion. Discuss how soil crusts help prevent erosion. Have students name several other things biological soil crusts provide for the natural environment. Have students name some things that can harm soil crusts. Discuss the characteristics of some local rocks.

2) Remind students that not all rocks were created the same way. Some rocks were once liquid inside the earth. We call these igneous rocks (show the appropriate poster). Ask students to name a rock that was once liquid (granite). Ask students what happens to rocks over time (erosion). Remind them that the sediments from erosion pile up. Ask students what happens to these sediments over millions of years (they harden into rocks). We call these rocks sedimentary rocks (show the appropriate poster). Tell the students that rocks sometimes get buried deep in the earth, melt, and change. If this happens, metamorphic rocks are formed (show the appropriate poster).

3) Pass out paper to each student and ask them to fold the paper in half. Bring out a box of rocks and give one to each student. Ask the students to draw their rocks on one side of their paper. Tell students not to trace their rocks because they do not want to accidentally draw on them. Tell the students to think about what type of rock they have while they are drawing. Ask them to write the type of rock under their drawing. Next, give each student a hand lens. Give the students a few minutes to examine their rocks and ask them to draw what they see on the other side of the paper. As students are working, walk around and discuss with individual students what type of rock they have.

4) When students are finishing up or there is only five minutes left, have students tell their neighbor one neat thing about their rock. Collect the hand lenses while they are talking. Next, have all the kids with igneous rocks raise them up and show the class. Point out some of the kinds of rocks you see. Repeat this activity with metamorphic and sedimentary rocks. Collect the rocks. Ask the students to raise their hands if they saw something with the hand lenses that they did not see with just their eyes. Do they think scientists use hand lenses to learn about rocks?

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Investigating rocks with a hand lens

National Park Service
U.S. Department of the Interior

National Park Service
Canyon Country Outdoor Education
2282 SW Resource Blvd.
Moab, UT 84532